APPEAL BRIEF UNDER 37 C.F.R. § 41.37

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Carlos Saldanha et al. Examiner: Jin-Cheng Wang

Serial No.: 09/439,225 Group Art Unit: 2628

Filed: November 12, 1999 Docket: 1162.007US1

For: SYSTEM AND METHOD FOR DISPLAYING SELECTED GARMENTS ON A COMPUTER-SIMULATED MANNEQUIN

APPEAL BRIEF UNDER 37 CFR § 41.37

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The Appeal Brief is presented in support of the Notice of Appeal to the Board of Patent Appeals and Interferences, filed on December 7, 2006, from the Final Rejection of claims 1-45 of the above-identified application, as set forth in the Final Office Action mailed on September 20, 2006.

The Commissioner of Patents and Trademarks is hereby authorized to charge Deposit Account No. 19-0743 in the amount of $250.00 which represents the requisite fee set forth in 37 C.F.R. § 41.20(b)(2). The Appellants respectfully request consideration and reversal of the Examiner's rejections of the pending claims.

1. REAL PARTY IN INTEREST

The real party in interest of the above-captioned patent application is the assignee, PUBLIC TECHNOLOGIES MULTIMEDIA, INC.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellant that will have a bearing on the Board's decision in the present appeal.

3. STATUS OF THE CLAIMS

The present application was filed on November 12, 1999 with claims 1-45. A non-final Office Action was mailed August 1, 2001. A Notice of Allowance was mailed January 14, 2002. A Request for Continued Examination was filed on April 12, 2002. A non-final Office Action was mailed July 17, 2002. A Final Office Action was mailed March 25, 2003. Applicant filed a Notice of Appeal July 28, 2003. An Advisory Action was mailed August 11, 2003. Following an Examiner Interview on December 17, 2003, a Restriction Requirement was mailed, also on December 17, 2003. Following another Examiner Interview on February 27, 2004, a non-final Office Action was mailed, also on February 27, 2004. Another non-final Rejection was mailed October 19, 2004. A Final Office Action was mailed May 31, 2005. A Notice of Appeal was filed September 30, 2005. An Advisory Action was mailed on December 28, 2005. A Request for Continued Examination was filed on February 2, 2006. A non-final Office Action was mailed April 10, 2006. A Final Office Action was mailed September 7, 2006. Claims 1-45 stand twice rejected, remain pending, and are the subject of the present Appeal.

4. STATUS OF AMENDMENTS

No amendments have been made subsequent to the Final Office Action dated September 7, 2006.

5. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed subject matter relates to methods or systems for simulating a dressing environment via computer. Such a simulated dressing environment is a user-operated display system that generates computer-simulated images of a human figure wearing one or more selected garments. The simulated human figure thus represents a virtual model or mannequin for modeling clothes that allows the user to see what different selected clothes look like when worn by different people. For example, a user may select a mannequin with dimensions similar to his or her own personal dimensions, see how different selected garments fit on the mannequin, and see how different combinations of garments look on the mannequin.

To facilitate understanding of the claimed subject matter, a very brief summary of some basic concepts in computer graphics will be given. The most realistic way to generate synthetic images that correspond to real-world objects is to first model the real-world objects in three-dimensional space. The present application refers to such a three-dimensional model of one or more objects as a three-dimensional simulation scene. Within the simulation scene, the individual objects may be represented geometrically by combinations of various geometric primitives. Most commonly, such geometric primitives are planar polygons whose position in the three-dimensional space of the simulation space is specified by assigning coordinates to the vertices of each polygon. Two-dimensional surfaces embedded in the three-dimensional space such as garments may be described by a plurality of such polygons connected together. The surface of a solid object such as a mannequin may be described by a plurality of interconnected polygons that enclose the volume of the mannequin. Different colors and textures may be associated with each such polygon. In order to obtain a more realistic simulation, the simulation scene may also model the physical properties of the objects and external forces that determine how such objects behave in the real world. In the present context, the modeling environment performs a draping and collision simulation within the simulation scene in which garment panels are connected together to form a garment which is then allowed to collide with the mannequin (and itself) in a simulated animation sequence that takes into account the physical forces involved.

In order to actually view the contents of a three-dimensional simulation scene such as described above on a computer display, the geometric primitives making up the objects in the scene must be transformed into a two-dimensional screen space that represents the pixels making up the display screen. Transformation of such primitives from the three-dimensional object space of the simulation scene to two-dimensional screen space is referred to as rendering. The further process of drawing the primitives on the display screen by setting individual pixel intensities according to whether or not a pixel falls within the area of a particular primitive is referred to as rasterization. There are two primary ways that images may be rendered from a three-dimensional simulation scene. In the world-to-screen method, the geometric primitives of the three-dimensional object space are mathematically projected into the two-dimensional screen space. For example, a matrix multiplication may be performed upon the coordinates of each vertex of a polygon in a manner that maps each vertex to the two-dimensional screen space. The projection of the primitives may be performed with a perspective transformation from a particular viewpoint or camera position. Various algorithms for hidden surface removal are then employed to determine which of the primitives should be visible in the image. In the screen-to-world method, for every pixel in the two-dimensional screen space, a simulated ray is projected from a specified camera position that passes through the pixel and then travels into the three-dimensional simulation scene until it intersects with a surface of a primitive. The intensity of the pixel is then set in accordance with the properties (e.g., color, lighting, texture) of the primitive with which the ray intersects.

The process of performing a draping and collision simulation from which an image can be rendered produces what is referred to in the present application as a rendering frame. One way of providing a simulated dressing environment is to simply generate a rendering frame in real-time for each selected mannequin and garment and then render an image from each such rendering frame. Simulating the draping and collision of a garment with a mannequin is computationally intensive, however, and real-time simulation may thus not be practical in many situations. The time involved in generating a rendering frame for a selected garment and mannequin is too long for a satisfactory user experience in these situations, with the problem being further exacerbated when it is desired to show the mannequin wearing multiple garments. A solution to this problem is represented by the subject matter of independent claims 34 and 44.

These claims recite a system in which two-dimensional images of mannequins and single garments are pre-rendered from rendering frames generated as described above and stored in a repository for later display in response to user inputs, where the garment images correspond to a plurality of different garments and views of such garments (See page 8, lines 7-23; Fig. 5; Fig. 10). If it were only desired to present images of a mannequin wearing a single garment, such a system could work without further modification. That is, in response to user selection of a particular mannequin and a particular garment for display, the system would retrieve two-dimensional images of the mannequin and garment from the repository and then layer the garment image upon the mannequin. Showing a mannequin wearing multiple garments in this manner by simply layering multiple pre-rendered garment images upon the mannequin, however, presents a problem because one garment affects how another garment fits on the mannequin. In order to deal with this problem, claims 34 and 44 further recite that each two-dimensional garment image in the repository is derived from a rendering frame generated by constraining portions of the garment to reside within or outside of one or more shells defined around the representative mannequin in the rendering frame during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment. (See page 8, line 24 to page 9, line 9; Fig.6.) The particular shell or shells used to generate a rendering frame for a garment define a particular version of that garment. Thus, in order to avoid the computational complexity of pre-rendering two-dimensional images corresponding to every possible combination of multiple garments on every possible mannequin, multiple versions of single garments may be defined which are then simulated and rendered into two-dimensional images, where the two-dimensional renderings of specific garment versions may then be combined with renderings of specific versions of other garments. Such versions of garments enable the garment images rendered from separate simulations to be combined in a composite image by layering the two-dimensional garment images upon one another. Claim 34 further includes a compositing rule interpreter for displaying the two-dimensional images of user-selected garments and of a selected mannequin in a layered order dictated by compositing rules (See page 9, lines 10-24). For example, a coat image would be layered on top of a shirt image. As an alternative to compositing rules, claim 44 further includes means for displaying the two-dimensional images of user-selected garments and of a

selected mannequin in a layered order determined from depth information contained in the simulation scene. That is, the computer system is programmed to maintain the three-dimensional depth information of the rendering frame for each two-dimensional garment image for use when that garment image is combined with another garment image by layering. Independent claims 1, 19, and 29 each recite either a method or system in which two-dimensional garment images are rendered from rendering frames generated with the use of shells to mimic other garments as described above with respect to claims 34 and 44.

Independent claims 16 and 32 recite a method and system, respectively, which utilize shape blending techniques to more efficiently generate rendering frames. A first three-dimensional rendering frame of a first mannequin wearing a first garment is generated in the manner described above with a draping and collision simulation. A second rendering frame containing a second mannequin and a second garment as defined by selected parameter values that specify different dimensions from the first mannequin and/or first garment may then be generated by shape blending corresponding objects of the first rendering frame, wherein the shape blending is performed by linearly combining parameters of the first rendering frame and performing a partial draping and collision simulation. (See page 2, lines 22-30; page 6, line 19 to page 7, line 22; Fig. 3; page 13, line 13 to page 14, line 5.) A repository of garment and mannequin images as described above may need to contain a very large number of images that correspond to different sizes of garments and mannequins. In order to rapidly and efficiently populate such a repository, shape blending techniques may be used to reduce the computational overhead. Alternatively, such shape blending techniques may be used to generate rendering frames in real-time from reference rendering frames from which mannequin and garment images may be rendered without the use of a repository. Only when the user selects a garment or mannequin that cannot be generated by linearly combining parameters from a previously generated rendering frame does a full draping and collision simulation need to be performed.

This summary does not provide an exhaustive or exclusive view of the present subject matter, and Appellants refer to the appended claims and its legal equivalents for a complete statement of the invention.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakaguchi (U.S. Patent No. 6,310,627) in view of Volino et al. ("The Evolution of a 3D System for Simulating Deformable Clothes on Virtual Actors," MIRALab 1998) and Weaver (U.S. Patent No. 6,404,426).

7. ARGUMENT

The pending claims all stand rejected under 35 U.S.C. §103(a). The rejections are respectfully traversed, and Appellants respectfully submit that the Final Office Action has failed to make a proper *prima facie* showing of obviousness for any of the pending claims. After a statement of Appellants' understanding of the applicable law, the rejections are addressed.

A) The Applicable Law under 35 U.S.C. §103(a)

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. M.P.E.P § 2143. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

B) Discussion of the rejections of claims 1-45 under 35 U.S.C. § 103(a) as being unpatentable over Sakaguchi (U.S. Patent No. 6,310,627) in view of Volino et al. ("The Evolution of a 3D System for Simulating Deformable Clothes on Virtual Actors," MIRALab 1998) and Weaver (U.S. Patent No. 6,404,426).

Appellants do not believe anything in the references cited in the Final Office Action teaches or suggests the subject matter recited by independent claims 1, 16, 19, 29, 32, 34, or 44 as discussed above. It appears to Appellants that the Sakaguchi, Volino et al., and Weaver references deal only with the three-dimensional simulation of a garment worn by a model and, among other things, do not contain any teachings that relate to the forming of composite images from pre-rendered two-dimensional garment and mannequin images stored in a repository, to methods of generating two-dimensional garment images that allow different versions to be

generated by the use of shells that mimic interaction with other garments, or to applying shape blending techniques to generate rendering frames from previously generated rendering frames. The specific points raised in the Final Office Action are addressed below.

Claims 1-15, 18-31, and 33-45

Claims 1-15, 18-31, and 33-45 recite methods or systems for producing an image of a garment or a mannequin wearing a garment that involve rendering a two-dimensional garment image from a three-dimensional rendering frame, where the rendering frame is generated by a draping and collision simulation of a garment with a mannequin while constraining portions of the garment to reside within or outside of one or more shells defined around the mannequin in the rendering frame during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment.

The Final Office Action points to the projection functions discussed in Sakaguchi (at cols. 21-25) that represent positional relationships between the triangular patches or lattice points that define the garment and figure model as at least suggesting "the shell defined around the mannequin." The Final Office Action goes on to say that Sakaguchi "discloses the shape of the garment (as broken into triangle patches) as fitted into the shape of the human model (col 25, lines 1-67; col.30, lines 24-65) wherein the shape of the garment are [sic] defined by the triangle patches which is the shell defined around the mannequin." Appellants simply do not understand this argument. As best understood, the cited portion of Sakaguchi deals with the generation of two-dimensional garment patterns suited for an individual client from a three-dimensional simulation of a standard model wearing a standard garment. The described technique deforms the standard garment image in accordance with the positional relationships between the vertices (i.e., lattice points) of the polygons (i.e., triangle patches) making up the standard model and the vertices of the polygons making up the standard garment in the simulation before and after changing the dimensions of the mannequin. Appellants do not see what this has to do with the shells as recited in the pending claims. The triangle patches are not a shell defined around the mannequin; they are the polygons that either make up the mannequin or the garment.

The Final Office Action also states that "Volino discloses, *inter alia*, the claim limitation

wherein each shell is a three-dimensional construct (the shell can be visualized in Volino Fig. 10) designed to mimic the physical interaction of the garment with another garment (Page 14) and rendering a two-dimensional image of the garment from the rendering frame and layering the rendered garment image upon a two-dimensional image of a selected mannequin (Page 14)." Appellants disagree with every assertion made in the quoted statement. Fig. 10 of Volino does not show any kind of shell designed to mimic the interaction of a garment with another garment; it merely shows a simulation scene containing a garment and a model. Page 14 of Volino does not discuss the use of a shell to mimic the effects of a garment and does not discuss the layering a two-dimensional image of a garment on a two-dimensional image of a mannequin. What is discussed on page 14 of Volino is the construction of garments or fabrics from two-dimensional (2D) panels for use in a three-dimensional simulation. These 2D panels are not two-dimensional images, however. Rather, they are two-dimensional surfaces that are embedded in the three-dimensional space of the simulation. As noted previously, Volino contains no teachings that relate to the generation of composite two-dimensional images by layering two-dimensional images upon one another.

Appellants finds no teaching or suggestion in Sakaguchi, Volino, or Weaver of a shell defined around the mannequin where the shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment during a draping and collision simulation. The recited limitation that the shells are designed to mimic the physical interaction of the garment with another garment is a positive functional limitation and not a mere statement of intended use. A functional limitation must be evaluated and considered, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used. MPEP 2173.05(g). The shells referred to in the claims act as surrogates for other garments in order to allow composite images of multiple garments to be rendered from separate rendering frames each containing only one garment. This allows a plurality of different versions of each garment image to be created and stored in a repository so that multiple two-dimensional garment images can be layered on a two-dimensional rendering of a mannequin, with the garments being rendered from rendering frames in an independent manner. Appellants find no discussion in any of the cited references that deal with the problems of producing images of a mannequin or model wearing multiple garments

from previously rendered two-dimensional garment images.

Claims 16-18 and 32-33

Claims 16-18 and 32-33 recite methods or systems for generating images of a computer-simulated mannequin wearing a garment that involve generating a second rendering frame containing a second mannequin and a second garment as defined by selected parameter values that specify different dimensions from a first mannequin and/or first garment contained in a first rendering frame by shape blending corresponding objects of the first rendering frame, wherein the shape blending is performed by linearly combining parameters of the first rendering frame and performing a partial draping and collision simulation.

The Final Office Action points to the discussion of a system for animating images in Sakaguchi (at cols. 30-32) as suggesting the shape blending technique for generating a rendering frame as claimed by appellants. Appellants, however, assert that animation *per se* is not shape blending. In any case, appellants find no teaching or suggestion in Sakaguchi for employing an animation system to generate a mannequin or garment having different dimensions from a previously generated mannequin or garment as presently claimed by using shape blending a partial draping and collision simulation. Appellants respectfully submit that claims 16-18 and 32-33 patentably define over Sakaguchi.

The Final Office Action also points to pages 10-11 of Volino as disclosing shape blending. It appears to Appellants, however, that the discussion at pages 10-11 of Volino relates to the use of different geometric primitives to represent objects. The "blending" being discussed in Volino refers to blending between geometric primitives; some primitives may be blended together and others may not. Thus, the cited portion of Volino in no way relates to the shape blending referred to in the pending claims.

Claims 6, 26, 34, 42 and 44

Appellants finds no teaching or suggestion in the cited references of a repository containing two-dimensional garment images that can be layered upon a mannequin to generate an image of the mannequin wearing multiple garments as recited by claims 6, 26, 34, and 44. The cited references only deal with three-dimensional simulation of a model wearing a garment

and/or the rendering of a single image from such a simulation. They do not appear to have any teachings that relate to storing two-dimensional images generated via a three-dimensional simulation in a repository, where such stored two-dimensional images are generated so as to be suitable for combining in a composite image by layering. The assertions to the contrary in the Final Office Action are simply wrong. Appellants are not arguing that the mere storing of two-dimensional images generated from a three-dimensional simulation in a repository by itself is patentably significant. It is the storing of such two-dimensional images that are generated in a manner allowing their combination in a composite image by layering that is neither taught nor suggested by the prior art of record. Nor is any teaching found in the references that relates to the stored two-dimensional images being rendered from a plurality of selectable camera angles as recited by claim 42.

Appellants further find no teaching or suggestion in the cited references for compositing rules or a compositing interpreter that define in what order specific garment images should be layered to thereby generate a composite two-dimensional image of the mannequin wearing the garments, or of combining images rendered from separate rendering frames containing different garments into a composite two-dimensional image using Z-coordinates of the garments. With regard to compositing rules or a compositing interpreter, the Final Office Action cites page 17 of Volino. Appellants find nothing in the cited portion of Volino that in any way relates to rules for layering two-dimensional images to form a composite image. With regard to the use of Z-coordinates, the Final Office Action cites Sakaguchi as disclosing the Z buffer method. Appellants are certainly not arguing that Z-buffering by itself is patentable. Z-buffering is a very common technique for hidden surface removal when rendering images from a three-dimensional scene using the world-to-screen method discussed earlier. What Appellants are arguing to be patentably significant in the present context is the use of Z-coordinates in layering two-dimensional images that have been previously rendered from three-dimensional simulation scenes.

8. SUMMARY

For the reasons argued above, claims 1-45 were not properly rejected under § 103(a). It is respectfully submitted that the claims are patentable over the cited art. Reversal of the rejections and allowance of the pending claims are respectfully requested.

Respectfully submitted,

CARLOS SALDANHA et al.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402

Date 3-7-07 By J. Kevin Parker
J. Kevin Parker
Reg. No. 33,024

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 7 day of March 2007.

John D. Gustav-Wrathall
Name

John D. Gustav-Wrathall
Signature

CLAIMS APPENDIX

1. A method for producing an image of a computer-simulated mannequin wearing a garment as defined by selected mannequin and garment parameter values, comprising:

generating objects corresponding to a representative mannequin and a garment placed in a simulation scene within a three-dimensional modeling environment;

simulating draping and collision of the garment with the representative mannequin within the simulation scene to generate a three-dimensional rendering frame of the representative mannequin wearing the garment;

constraining portions of the garment to reside within or outside of one or more shells defined around the representative mannequin in the rendering frame during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment; and,

rendering a two-dimensional image of the garment from the rendering frame and layering the rendered garment image upon a two-dimensional image of a selected mannequin.

2. The method of claim 1 wherein the rendered image is used to form a visual image on a computer display device.

3. The method of claim 1 further comprising generating rendering frames containing mannequin or garment objects as defined by selected parameter values by shape blending corresponding objects of previously generated rendering frames.

4. The method of claim 1 wherein the garment object comprises a plurality of garment panels that are connected together during the draping and collision simulation and further wherein the garment parameters include panel dimensions.

5. The method of claim 1 wherein two-dimensional images are rendered from a rendering frame using a plurality of camera positions.

6. The method of claim 1 further comprising storing the rendered garment image in a repository for containing a plurality of two-dimensional garment images.

7. The method of claim 1 further comprising generating multiple rendering frames for a plurality of different garments and layering a plurality of two-dimensional images of the different garments upon the selected mannequin.

8. The method of claim 7 wherein specific versions of the different garments are defined that reside within or outside of one or more shells during the draping and collision simulations that generate the multiple rendering frames and further wherein the versions of the different garments are selected in accordance with versioning rules that define which versions of a particular garment are permitted when combined with another particular garment.

9. The method of claim 7 wherein separate rendering frames are generated for each of the different garments.

10. The method of claim 9 wherein the separate rendering frames are combined into a composite two-dimensional image using Z-coordinates of the objects.

11. The method of claim 9 wherein the garments contained in the separate rendering frames are rendered into separate two-dimensional garment images that are layered upon a two dimensional rendering of the mannequin to create a composite two-dimensional image.

12. The method of claim 11 further comprising layering the separate two-dimensional images on a two-dimensional image of the mannequin in accordance with a compositing rule that defines in what order specific garment images should be layered to thereby generate a composite two-dimensional image of the mannequin wearing the garments.

13. The method of claim 1 further comprising mapping texture objects to the garment objects in rendering frames wherein the texture objects are selected from a group consisting of colors, fabric patterns, buttons, collars, and ornaments.

14. The method of claim 1 wherein an image rendered from the rendering frame is transmitted over a network to a display device.

15. A processor-readable storage medium having processor-executable instructions for performing the method recited in claim 1.

16. A method for producing an image of a computer-simulated mannequin wearing a garment as defined by selected mannequin and garment parameter values, comprising:

generating objects corresponding to a first mannequin and a first garment placed in a simulation scene within a three-dimensional modeling environment;

simulating draping and collision of the first garment with the first mannequin within the simulation scene to generate a first three-dimensional rendering frame of the first mannequin wearing the first garment;

generating a second rendering frame containing a second mannequin and a second garment as defined by selected parameter values that specify different dimensions from the first mannequin and/or first garment by shape blending corresponding objects of the first rendering frame, wherein the shape blending is performed by linearly combining parameters of the first rendering frame and performing a partial draping and collision simulation; and,

rendering an image from the second rendering frame.

17. The method of claim 16 wherein the garment object comprises a plurality of garment panels that are connected together during the draping and collision simulation and further wherein the garment parameters include panel dimensions.

18. The method of claim 16 further comprising constraining portions of the garment to reside within or outside of one or more shells defined around the mannequin in each rendering frame

during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment.

19. A method for generating an image of a computer-simulated garment suitable for combining into a composite image of a selected computer-simulated mannequin wearing selected garments, comprising:

generating objects corresponding to a mannequin and a garment placed in a simulation scene within a three-dimensional modeling environment;

simulating draping and collision of the garment with the mannequin in the simulation scene to generate a three-dimensional rendering frame containing the mannequin wearing the garment;

constraining portions of the garment to reside within or outside of one or more shells defined around the mannequin in the rendering frame during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment; and,

rendering a two-dimensional garment image from the rendering frame.

20. The method of claim 19 further comprising rendering images of a plurality of versions of particular garments that are combinable into composite images in accordance with versioning rules, wherein a version of a garment is generated by constraining portions of the garment object within a rendering frame to reside within or outside of a particular shell defined around the mannequin.

21. The method of claim 20 further comprising generating rendering frames containing mannequin or garment objects as defined by selected parameter values by shape blending corresponding objects of one or more previously generated rendering frames.

22. The method of claim 19 further comprising mapping texture objects to the garment object in a rendering frame before rendering the garment into a two-dimensional garment image.

23. The method of claim 19 further comprising rendering from a rendering frame a plurality of garment images corresponding to a plurality of camera positions.

24. The method of claim 20 wherein a garment in the rendering frame is modified in accordance with a selected garment parameter value by modifying the parameter in the rendering frame and performing a partial further simulation to simulate motion and collision of the modified garment with the mannequin.

25. The method of claim 24 wherein the garment model comprises a plurality of garment panels that are connected together during the draping and collision simulation and wherein the garment parameters include panel dimension parameters.

26. The method of claim 20 further comprising storing in a garment image repository garment images corresponding to a plurality of garment parameter values and created for a population of mannequins defined by a plurality of parameter values.

27. The method of claim 20 wherein the versions of particular garments that are rendered into garment images include versions differing by a fitting characteristic.

28. The method of claim 20 wherein the versions of particular garments that are rendered into garment images include versions differing by a wearing style.

29. A system for generating images of a computer-simulated mannequin wearing a garment as defined by selected mannequin and garment parameter values, comprising:

a user interface by which a user selects a mannequin and one or more garments to be worn by the mannequin, wherein the mannequin and garments selected may be further defined by specific mannequin and garment parameter values;

a three-dimensional modeling environment for generating objects corresponding to a representative mannequin and a garment placed in a simulation scene and for simulating draping and collision of the garment with the mannequin within the simulation scene to generate a three-

dimensional rendering frame of the mannequin wearing the garment; means for constraining portions of the garment to reside within or outside of one or more shells defined around the representative mannequin in the rendering frame
during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment; and,

means for rendering a two-dimensional image of the garment from the rendering frame and layering the rendered garment image upon a two-dimensional image of the selected mannequin.

30. The system of claim 29 further comprising means for layering a plurality of two-dimensional garment images upon the two-dimensional image of the selected mannequin, wherein each garment image is rendered from a rendering frame generated by constraining portions of a selected garment to reside within or outside of one or more shells defined around a representative mannequin in the rendering frame during the draping and collision simulation, and wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the selected garment with another garment.

31. The system of claim 30 wherein the plurality of two-dimensional garment images for layering upon the selected mannequin image are selected in accordance with versioning rules that define which versions of a particular garment are permitted when combined with another particular garment.

32. A system for generating images of a computer-simulated mannequin wearing a garment as defined by selected mannequin and garment parameter values, comprising:

a user interface by which a user selects a mannequin and one or more garments to be worn by the mannequin, wherein the mannequin and garments selected may be further defined by specific mannequin and garment parameter values;

a three-dimensional modeling environment for generating objects corresponding to a representative mannequin and a representative garment placed in a simulation scene and for simulating draping and collision of the representative garment with the representative mannequin

within the simulation scene to generate a first three-dimensional rendering frame of the mannequin wearing the garment;

means for generating a second rendering frame containing the selected mannequin and the selected garment as defined by selected parameter values that specify different dimensions from the representative mannequin and/or representative garment by shape blending corresponding objects of the first rendering frame, wherein the shape blending is performed by linearly combining parameters of the first rendering frame and performing a partial draping and collision simulation; and,

rendering an image from the second rendering frame.

33. The system of claim 32 further comprising means for constraining portions of the garment to reside within or outside of one or more shells defined around the mannequin in each rendering frame during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment.

34. A system for displaying a selected computer-simulated mannequin wearing a selected garment, comprising:

a user interface by which a user selects a mannequin and one or more garments to be worn by the mannequin, wherein the mannequin and garments selected may be further defined by specific mannequin and garment parameter values;

a repository containing a plurality of two-dimensional garment images and mannequin images as defined by specific parameters;

wherein each two-dimensional garment image in the repository is generated by:

generating objects corresponding to a representative mannequin and a garment placed in a simulation scene within a three-dimensional modeling environment,

simulating draping and collision of the garment with the representative mannequin within the simulation scene to generate a three-dimensional rendering frame of the representative mannequin wearing the garment,

constraining portions of the garment to reside within or outside of one or more shells defined around the representative mannequin in the rendering frame during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment, and

rendering a two-dimensional image of the garment from the rendering frame; and,

a compositing rule interpreter for displaying the two-dimensional images of user-selected garments and of a selected mannequin in a layered order dictated by compositing rules.

35. The system of claim 34 wherein the garment images contained in the repository include images of different versions of garments, wherein different versions of a particular garment are combinable with specific other garments.

36. The system of claim 35 further comprising a versioning rule interpreter for choosing among versions of the garment images for displaying in accordance with versioning rules that define which versions of particular garments are permitted when combined with another particular garment.

37. The system of claim 35 wherein the compositing rule interpreter displays two-dimensional images of versions of user-selected garments chosen by the versioning rule interpreter and of a selected mannequin in a layered order dictated by the compositing rules.

38. The system of claim 34 wherein the repository includes garment images rendered from rendering frames generated by shape blending corresponding objects of previously generated rendering frames.

39. The system of claim 34 wherein the mannequin parameters include a parameter corresponding to a body measurement.

40. The system of claim 34 wherein the mannequin parameters include a parameter designating selection of a particular mannequin from a population of mannequins.

41. The system of claim 34 wherein the garment parameters are selected from a group consisting of dimension, color, and style.

42. The system of claim 34 wherein the plurality of two-dimensional garment and mannequin images are rendered from a plurality of selectable camera angles.

43. The system of claim 34 wherein the user interface permits selection of versions of particular garments that are rendered into garment images that exhibit a particular wearing style.

44. A system for displaying a selected computer-simulated mannequin wearing a selected garment, comprising:

a user interface by which a user selects a mannequin and one or more garments to be worn by the mannequin, wherein the mannequin and garments selected may be further defined by specific mannequin and garment parameter values;

a repository containing a plurality of two-dimensional garment images and mannequin images as defined by specific parameters;

wherein each two-dimensional garment image in the repository is generated by:

generating objects corresponding to a representative mannequin and a garment placed in a simulation scene within a three-dimensional modeling environment,

simulating draping and collision of the garment with the representative mannequin within the simulation scene to generate a three-dimensional rendering frame of the representative mannequin wearing the garment,

constraining portions of the garment to reside within or outside of one or more shells defined around the representative mannequin in the rendering frame during the draping and collision simulation, wherein each shell is a three-dimensional construct designed to mimic the physical interaction of the garment with another garment, and

rendering a two-dimensional image of the garment from the rendering frame; and,

means for displaying the two-dimensional images of user-selected garments and of a selected mannequin in a layered order determined from depth information contained in the simulation scene.

45. The system of claim 44 wherein the plurality of two-dimensional garment and mannequin images are rendered from a plurality of selectable camera angles.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.